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# Direct measurement of key nuclear astrophysics reactions down to the Gamow window in a deep underground laboratory (JUNA)

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Precision measurement of key reaction rates for stellar processes is essential to resolve nuclear uncertainties in the stage of precision numerical simulation of star evolution and element synthesis. Thanks to the ultra-low cosmic ray background, mA level intense beams of proton and alpha with 0.1 keV energy precision, plus 100 C level radiation-proof target and high-efficiency gamma and neutron detector, the JUNA team was able to achieve a sensitivity of $10^{-14}$ mb. The highlights and prospects of JUNA will be presented, including the explanation of abundant Ca in the earliest star by $^{19}F(p,\gamma)^{20}Ne$ reaction, high precision of 1.8 MeV gamma production rate by $^{25}Mg(p,\gamma)^{26}Al$ reaction, removing the neutron source uncertainties by $^{13}C(\alpha,n)^{16}O$reaction, and the first results of $^{12}C(\alpha,\gamma)^{16}O$ Holy Grail reaction close to the Gamow window.

## Collaboration (if any)

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